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THE INFLUENCE OF METACOGNITIVE KNOWLEDGE TO STUDENT LEARNING OUTCOMES ON SALT HYDROLYSIS MATTER IN XI SCIENCE 4 RSBI SMAN MOJOAGUNG JOMBANG

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Abstract: The aims of this study is determining the effect of metacognitive knowledge on student learning outcomes. In the application of metacognitive strategies is to use *Direct Instruction* model of teaching. The design of the research is done is by giving written test that has been integrated with metacognitive strategies. Given problem involves a matter of cognitive and metacognitive knowledge consists of declarative, procedural and conditional. Data results of metacognitive knowledge is symbolized by the variable X and student learning outcomes is symbolized by the variable Y. Then the variables X and Y wanted to do using the correlation coefficient formula. The results showed that there is a very strong relationship between metacognitive knowledge and student learning outcomes are the results of the correlation coefficient of 0.815. While based on the r-theoretical price by N = 34 r-Theoretic be obtained at 1% significant level is 0.436. Because the price r of 0.815 so that it can be stated that the correlation between metacognitive knowledge and student learning outcomes significantly. Variance metacognitive knowledge that includes declarative knowledge, procedural knowledge, and knowledge of the conditional variance of 66.4% can clarify student learning outcomes. This suggests that metacognitive knowledge is very influential on student learning outcomes.

Keywords: metacognitive knowledge, learning results, *Direct Instruction* Model Learning

Abstrak : Penelitian ini bertujuan untuk mengetahui pengaruh pengetahuan metakognitif terhadap hasil belajar siswa. Dalam penerapan strategi metakognitif ini menggunakan model pembelajaran *Direct Instruction*. Rancangan penelitian yang dilakukan adalah dengan memberikan tes tulis yang sudah diintegrasikan dengan strategi metakognisi. Soal yang diberikan meliputi soal kognitif dan metakognitif yang terdiri dari pengetahuan deklaratif, prosedural dan kondisional. Data hasil pengetahuan metakognitif disimbolkan dengan variabel X dan hasil belajar siswa disimbolkan dengan variabel Y. Kemudian variabel X dan Y dicari hubungannya menggunakan rumus koefisien korelasi. Hasil penelitian menunjukan bahwa terdapat hubungan yang sangat kuat antara pengetahuan metakognitif dan hasil belajar siswa yaitu dengan hasil koefisien korelasi sebesar 0,815. Sedangkan berdasarkan harga r-teoritik dengan N=34 akan diperoleh r-teoritik pada taraf signifikan 1% adalah 0,436. Karena harga r sebesar 0,815 sehingga dapat dinyatakan bahwa korelasi antara pengetahuan metakognitif dan hasil belajar siswa signifikan. Varians pengetahuan metakognitif yang meliputi pengetahuan deklaratif, pengetahuan prosedural, dan pengetahuan kondisional sebesar 66,4% dapat memperjelas varians hasil belajar siswa. Hal ini menunjukkan bahwa pengetahuan metakognitif sangat berpengaruh terhadap hasil belajar siswa.

Kata Kunci: Pengetahuan metakognitif, Hasil belajar, Model Pembelajaran *Direct Instruction*

INTRODUCTION

Education is the most important pillars in the development of a nation. Education is a dynamic thing that requires continuous improvement. The Government continues to strive to improve the quality of education, one of the ways is by developing a curriculum from time to time. Current curriculum used is Education Unit Level Curriculum (SBC). Education Unit Level Curriculum (SBC) is an attempt to refine the curriculum to make it more familiar to teachers, because they are much involved, it is expected that teachers have more responsibility in the implementation.

Improved quality of teaching is also done by preparing an international study which started holding an international school pilot called international school stubs (RSBI). This international standard school stubs using adaptive and adoptive kurikurulum is using SBC as a national curriculum, combined with the *Cambridge International Examination (CIE)* as a reference intenasional curriculum. The curriculum is arranged applied in all subjects, including chemistry. Quality of any school / Madrasah international standard is also guaranteed by the success of implementing the curriculum completely. The curriculum is a reference in preparing the syllabus and learning implementation plan. The success was marked by the achievement of key performance indicators at least the following:

1. Applying Education Unit Level Curriculum (SBC);
2. Applying semester credit unit system in MA / SMK / MA / MAK;
3. Meet the Content Standards, and
4. Graduates meet the Competency Standards

Students according to Piaget's cognitive development is divided into four stages, namely sensorimotor stage, preoperative, concrete operations and formal operations. However, Piaget's theory has been criticized by R. Case stated on Neo-Piagetian theory.

Neo-Piagetian theory is a modification of Piaget's theory. In contrast to Piaget's theory, Neo-Piagetian theory gives greater emphasis on social influences on cognitive development and the environment (Nur, 1998: 28). To optimize students' comprehension skills and metacognitive strategies are needed. Teach metacognitive strategies to students can lead to the improvement of their learning outcomes significantly (Nur, 1999: 42).

Chemistry is one of the science that is very applicable to life, all the things learned in chemistry can be found in everyday life. This is supported by the results of research that has been pre questionnaire given to 25 students in the Jombang Mojoagung RSBI SMAN 76% liked the chemistry and 68% said that the interesting chemistry lessons to be learned.

Based on the pre-study questionnaire that was given to 25 students who have been through or get the material as much as 56% hydrolysis of the salt that the salt hydrolysis is a material that is considered difficult. Therefore, this material was chosen as the object of research. This material was chosen as the research object because when students are working on about a matter, it will be necessary processing stages such questions. Both the multiple choice questions and students will still complete description of such questions in stages with a specific stage as well. Perhaps each student will have the means as well as the different stages pengerjaaan each other. It is only fair, because every student has different abilities and reasoning. From this reason, it is important for students to understand how thinking and learning styles to enhance the effectiveness of their own learning.

Awareness of what is known and what is not known to be a definition of metacognitive. Metacognitive refers to a way to raise awareness of thinking and learning requirements. Berpkir skills and learning occurs when a student is

able to locate the fault and find a way to fix it. According to Martinez (2006), metacognitive functions are divided into three categories, namely: 1) assess the skills of system memory *(metamemory)* and assess the skill level of self-understanding *(metacomprehension),* 2) solving problems *(problem solving),* 3) critical thinking *(critical thinking).*

Flavell (in Slavin, 2000) describes metacognition as one's knowledge about themselves and about learning how to learn. Meanwhile, Brown (in Lee and Baylor, 2006) describes metacognition consists of activities to manage and monitor human learning. And the second picture, looks a different emphasis on metacognition. Flavell tend to view metacognition of knowledge about the cognitive aspects of a person, while Brown tend to view metacognition as the set one's cognition.

Although Flavell and Brown has a tendency different depictions of metacognition, but both are of the view that metacognition includes two aspects are interrelated and interdependent on one another. Flavell argued that metacognition consists of (1) metacognitive knowledge *(knowledge metakognititf},* and (2) metacognitive experiences or regulation *(metakognititf experience or regulation)* (Flavell, 1979; Livingston, 1997). On the other hand, Brown also divides metacognition into: (1) knowledge of cognition *(knowledge about cognition),* and (2) regulation of cognition *(regulation of cognition)* (in Gay, 2002).

Flavell (1979) states that there are three main factors or variables in metacognitive knowledge, namely: (1) individual, (2) tasks, and (3) strategy. Category of "individuals" covers everything that is believed to be a person of character and others as cognitive processors. This is related to the type of acquired knowledge and beliefs about human beings as cognitive. Category of "tasks" related to the information available to a person during cognitive activity. Category of "strategy" is related to an important issue of knowledge that can be obtained through the possibility of effective strategies to achieve goals in a cognitive effort.

Cognition and metacognition is essentially a series of thought and activity by man. When discussing the development of metacognition, despite not actually talk about the development of cognition itself, so it is no exaggeration to say that cognition and metacognition is a series that can not be separated. Panaoura and Philippou (2001) suggested that the development of metacognition that is not an automatic process, but is the result of a long process of development of cognitive systems.

Judging from the dimensions of metacognitive knowledge, Flavel (1979) assume that metacognitive knowledge has much in common with cognitive knowledge, the only difference occurs in how to use the information. So although it can be argued from the differences in metacognitive knowledge with cognitive knowledge, but both have the same knowledge base.

Viewed from the aspect of strategy, cognitive strategies and metacognitive strategies are strung with a very close and depend on each other, so that any attempt to test one another regardless, would not provide an adequate description (Livingston, 1997). In practical terms, metacognitive strategies and cognitive strategies can take place in parallel within the same strategy. For example, one can use the strategy of the question itself *(self-question)* and read with a view to acquiring knowledge (cognitive), or as a way to monitor what people are reading (metacognitive). From these examples it can be said that the cognitive strategies used to help individuals achieve a goal tententu, while metacognitive strategies are used to ascertain whether the objectives have been achieved (Livingston, 1997).

Based on the results of pre-study questionnaire was conducted on 25 students who have exhausted or have material salt hydrolysis. The

questionnaire contained 18 statements metacognitive inventory (both positive and negative statements) which consists of six statements about declarative knowledge, procedural knowledge statements about 6, and 6 conditional statements about knowledge. From the results obtained that knowledge questionnaire for 61.5% of students declarative, procedural knowledge students by 59%, and conditional knowledge of students by 58%. This shows that the awareness of students' metacognitive knowledge is still low.

Formulation of research problem is how metacognitive knowledge effects on student learning outcomes in the hydrolysis of the material in class XI IPA salt RSBI SMAN 4 Mojoagung Jombang.

The purpose of this study is to influence metacognitive knowledge of students' learning outcomes in the hydrolysis of the material in class XI IPA salt RSBI SMAN 4 Mojoagung Jombang.

METHOD

The study used to measure students' metacognitive skills in the application of metacognitive strategies in learning models directly *(Direct Instruction)* hydrolysis of salts on the material in class XI IPA 4 RSBI Mojoagung Jombang SMA is to provide write tests that have been integrated with metacognitive strategies. Given problem involves a matter of cognitive and metacognitive knowledge consists of declarative, procedural and conditional. In addition to these data support the students were also given an inventory sheet of metacognition to students and researchers analyzed data descriptively.

Targets in this study were 34 high school students class XI IPA 2 RSBI SMAN 4 semesters Mojoagung Jombang in Salt Hydrolysis material.

While the source of the data in this study is the primary data and secondary data. Primary data obtained from the test results of students who have been integrated with students' metacognitive skills. While the secondary data obtained from inventory data metacognitive students.

The research instrument used in the form of a booklet *final test.* This booklet is used to view the achievement of the indicators as designed in the lesson plan so that it can be seen how the student learning outcomes. Additionally test questions have been designed with the integration of metacognitive strategies in the matter. metacognitive strategies contained in the matter related to metacognitive knowledge include declarative knowledge, procedural, and conditional. Examples of *the final test* question:

Question 1

a. *Explain the the hydrolysis of 0, 1 M* $(NH_4)_2SO_4$ *solution. Work out the pH of the solution given That* K_b *for* NH_3 *is 1.8 x* 10^{-5} *mol / L. (Cognition)*
b. *To answer the question above, what the content knowledge related to? Explain! (Declarative knowledge)*
c. *Display what your thought to Obtain the answer! (Procedural Knowledge)*
d. *Explain when and why you use Such a thought process above to find the answer! (Conditional Knowledge)*

As for the question regarding students' metacognitive knowledge was analyzed according to the assessment rubric metacognitive knowledge as presented in Table 1:

Tabel 1 *Overview of scoring criteria*

Score	***Description***		
	Declarative knowledge	***Procedural knowledge***	***Conditional knowledge***

0	*Nothing relevant to the task. The student does not describe what the task related to*	*Students do not describe which strategy they use to solve a problem, and how they solve that problem*	*Students do not explain when and why to use strategies to solve problem*
1	*Students writes nonspecific statements that are related to chemistry but they are not related to the question*	*Students seem to understand of the task purpose, but they make nonspecific statements that are not interrelated or connected between given information and the question*	*Students lists general strategies used to solve problem, but they do not explain only when or why to use that strategies or nonspecific statement*
2	*Students has a clear overview of what the task is related to*	*Students has clearly defined which strategy they use. Students explicitly consider the implications between given information and the question*	*The students generates clearly when and why to use strategies they use to solve problem. The overview of their strategy connects concretely to the given information and the question*

Rompayom,P. *et al*.[7]

Data obtained from the tests were analyzed descriptively. This test data is analyzed into two parts about the cognitive and metacognitive knowledge about covering the declarative knowledge, procedural and conditional. For about the cognitive analyzed descriptively to determine student learning outcomes.

$$Student\ Learning\ Outcomes = \frac{Gain\ Score}{Maximal\ Score}\ x\ 100$$

then analyzed descriptively by comparing the values specified in RSBI SKBM SMAN Mojoagung Jombang chemical subjects that is equal to 77.

Data obtained from the knowledge of students' metacognitive and statistically analyzed using the correlation formula. Data metacognitive knowledge is symbolized by the variable X and the learning symbolized by the variable Y. Then the variables X and Y wanted to do using the correlation coefficient formula. Based on (Ferguson, 1981) formerly of these variables determined the standard deviation of each variable (S_X and S_Y) using the formula:

$$s_X^2 = \frac{\sum(X - \bar{X})^2}{N - 1}$$

$$s_Y^2 = \frac{\sum(Y - \bar{Y})^2}{N - 1}$$

So that for the standard deviation can be set to search for roots

$$s_X = \sqrt{s_X^2}$$

$$s_Y = \sqrt{s_Y^2}$$

Having determined the standard deviation of the variables X and Y is converted to the form of *standard scores* using the formula:

$$z_X = \frac{X - \bar{X}}{s_X}$$

$$z_Y = \frac{Y - \bar{Y}}{s_Y}$$

Once these variables are converted to *standard score* form we then look for a relationship between two variables by using the formula of correlation (r).

$$r = \frac{\sum Z_x Z_y}{N-1}$$

Description:
r: correlation coefficient
N : number of data
z_X : *Standard score* for variable X
z_Y : *Standard score* for the variable Y

In this study to find the correlation coefficient using the standard formula score for the data obtained is converted into a Z-score or standard score. Correlation coefficient was used to measure the degree of relationship between students' metacognitive. Generally applicable $0 \leq r^2 \leq 1$ so that the correlation coefficient obtained for $-1 \leq r \leq$ relationships $+1$.

To determine the magnitude of the correlation coefficient is the relationship can be seen in the following table:

Table 2 Guidelines for Interpretation of the Correlation Coefficient

Coefficient Interval	Relationship level
0,000-0,199	Very low
0,200-0,399	low
0,400-0,599	Sufficient
0,600-0,799	Strong
0,800-1,000	Very strong

RESULTS AND DISCUSSION

Metacognitive knowledge about the students gained from the *final test* which has integrated with metacognitive knowledge that includes declarative knowledge, procedural knowledge and conditional knowledge. Metacognitive knowledge of students' results will be correlated with student learning outcomes to look for a correlation coefficient. Have obtained the students' metacognitive knowledge about the *final test* to move between 12 and 24 of the maximum score is 24. Number of values is then divided by the number of students and the average values obtained at 17.8 or at 74.16%. This indicates that the value of metacognitive knowledge can be said to be good students.

Once applied metacognitive knowledge of students through *Direct Instruction* learning model based on the average value of *the final test* there are 4 students who otherwise do not complete or get value less than 77. Traditionally after the application of metacognitive knowledge of students through *Direct Instruction* learning model for 88.02% of students declared complete. Thus it can be seen that after the application of metacognitive knowledge of students through the *Direct Instruction* model of teaching students the value there is an increase in the classical style and thoroughness. If viewed from the analysis is said to be complete in the study as shown in Figure 1:

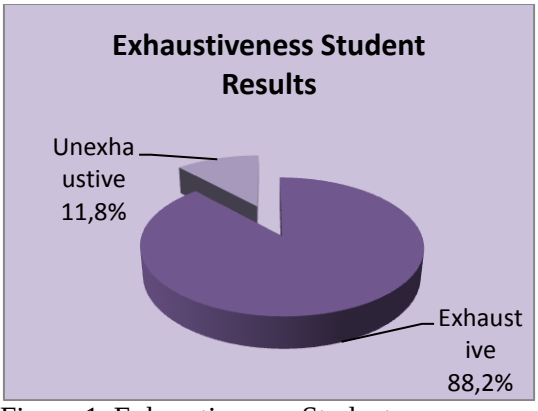

Figure 1. Exhaustiveness Student Results

Based on calculations derived r value of 0.815. Because the results obtained by calculating r 0.815 and based on the correlation coefficient table interpretation guidelines can be concluded that the correlation between students' metacognitive and has a very strong level. While based on the r-theoretical price by N = 39 r-Theoretic be obtained at 1% significant level is 0.436. Because the price r of 0.815, it can be stated that the correlation

between students' metacognitive and significant. Of r values obtained through the calculation can be determined how much of the variance contribution to the variance metacognitive learning outcomes of students with finding the value of r $^{2.}$ In this study obtained r value of 0.664. This shows that the variance of the metacognitive knowledge includes declarative knowledge, procedural knowledge, and knowledge of the conditional variance of 66.4% to clarify the learning outcomes of students. Of these explanations can be made a pie chart as follows:

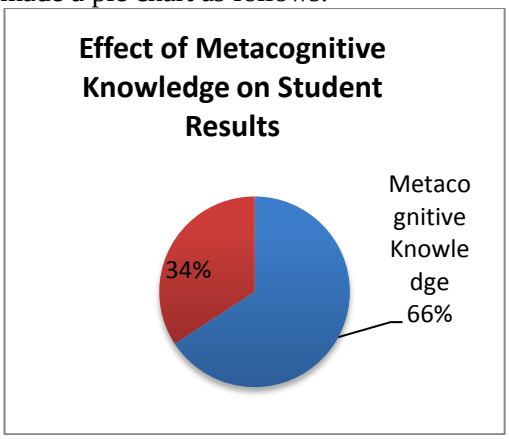

Figure 2. Effect of Metacognitive Knowledge on Student Results

From the above pie chart can be seen that 66.4% profile metacognitive knowledge affects students' profiles obtained for the variance accounted for 66.4% metacognitive against student learning outcomes.

CONCLUSION

The results of calculating r between metacognitive knowledge and student learning outcomes at 0.815. It can be concluded that the correlation between Metacognitive knowledge and student learning outcomes have high levels of relationship is very strong. While based on the r-theoretical price by N = 34 r-Theoretic be obtained at 1% significant level is 0.436. Because the price r of 0.815 so that it can be stated that the correlation between metacognitive knowledge and student learning outcomes significantly.

Of r values obtained through the calculation can be determined how much of the variance contribution to the variance metacognitive learning outcomes of students with finding the value of r $^{2.}$ In this study obtained r value of 0.664. This shows that the variance of the metacognitive knowledge includes declarative knowledge, procedural knowledge, and knowledge of the conditional variance of 66.4% to clarify the learning outcomes of students.

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